REMARKS

In the Office Action mailed on November 1, 2005 claims 1-38 were rejected. By the present response, claims 1 and 20 have been amended, and claims 12-14 and 31-33 have been canceled. Upon entry of the amendments, claims 1-11, 15-30, and 34-38 will be pending in the application. Reconsideration and allowance of all pending claims are requested.

Claim Objections:

Claim 33 has been objected because of the following informalities: "control" is misspelled. Claim 33 has been cancelled.

Rejections Under 35 U.S.C. § 102

Claims 1, 10-13, 16-20, 26-32 and 35-38 are rejected under 35 U.S.C. § 102(c) as being anticipated by Brunell et al. (U.S. Patent No. 6,823,675, hereinafter, "Brunell A").

Independent Claims 1, 20 and Claims Depending Therefrom

By the present response, claims 1 and 20 have been amended to include the subject matter recited by claims 14, 15 and 33, 34 respectively, in order to particularly point out and distinctly claim the subject matter.

Brunell A does not disclose an optimization algorithm with an infinite control horizon

Brunell A discloses adaptive model-based control systems and methods for controlling a gas turbine engine. The adaptive model-based control systems and methods comprise a system model, estimators, model-based diagnostics, and a model-based control or a model-predictive control (MPC).

As recited in col. 9, lines 45-48:

> The best control sequence can be determined by converting the problem into a form that an optimization algorithm can solve. MPC is based on the constrained open-loop optimization of a finite horizon objective function.

It is also well known in the art that standard MPC quadratic programming formulations deal with optimization with constraints over a "finite" control horizon, since the computational burden grows with increasing horizon.

Hence, Brunell A fails to teach an optimization algorithm using an infinite control horizon. In view of the fact that Brunell A does not disclose the above-discussed recitation of amended claims 1 and 20, Applicants respectfully submit that claims 1 and 20 are not anticipated by Brunell A.

Since claims 10-13, and 16-19 are dependable on allowable base claim 1, and claims 26-32 and 35-38 are dependable on allowable base claim 20, Applicants respectfully submit that the aforementioned claims are not anticipated by Brunell A.

Claims 1-13, 16-32 and 35-38 are rejected under 35 U.S.C. § 102(e) as being anticipated by Brunell (U.S. Patent No. 6,823,253, hereinafter, "Brunell B").

Brunell B does not disclose an optimization algorithm using an infinite control horizon

Brunell B discloses methods and apparatus for non-linear model predictive control (NMPC) of an aircraft gas turbine. The method includes providing an online dynamic optimizer that dynamically optimizes and controls operation of the gas turbine engine using NMPC based on an operations model and operations and control constraints using an extended Kalman filter for estimation.

As recited in col. 5, lines 7-10:

> The current strategy for this invention involves trying to collapse the controller into an objective function (s) and constraint (s) that is used as part of a finite horizon constrained optimization problem.

Further, as recited in col. 2, lines 12-14:

FIG. 3 illustrates an implementation of NMPC based on the constrained open-loop optimization of a finite horizon objective function.

Therefore, Brunell B fails to teach an optimization algorithm that uses an infinite control horizon. In view of the fact that Brunell B does not disclose the above-discussed recitation of amended claims 1 and 20, Applicants respectfully submit that claims 1 and 20 are not anticipated by Brunell B.

Since claims 2-13, 16-19 are dependable on allowable base claim 1, and claims 21-32, and 35-38 are dependable on allowable base claim 20, Applicants respectfully submit that the aforementioned claims are not anticipated by Brunell B.

Claims 1-11, 17-32 and 36-38 are rejected under 35 U.S.C. § 102(e) as being anticipated by Desai et al (U.S. Patent No. 6,729,139, hereinafter, "Desai").

Desai does not disclose a horizon based optimization algorithm

Desai discloses a control system for a turboshaft engine of a helicopter. The optimization algorithm used herein is a linear quadratic regulator (LQR) and is not based on a control horizon. In addition, the Examiner has recited in page 9, lines 3-4 of the office action that Desai does not teach the horizon based control algorithm.

Hence, Desai fails to teach an optimization algorithm based on a control horizon. In view of the fact that Desai does not disclose the above-discussed recitation of amended claims 1 and 20, Applicants respectfully submit that claims 1 and 20 are not anticipated by Desai.

Since claims 2-11 and 17-19 depend on allowable base claim 1, and claims 21-32 and 36-38 depend on allowable base claim 20, Applicants respectfully submit that the aforementioned claims are not anticipated by Desai.

Rejections Under 35 U.S.C. § 103

Claims 1-38 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Desai in view of Ward.

Ward teaches an optimization algorithm using an infinite horizon but is different from that in the application

Ward teaches a system for adaptive and reconfigurable control of aircraft and other complex objects, wherein the system uses a LQR optimization algorithm which is based on an infinite control horizon. However, this technique uses standard Ricatti equations for LQR that is applicable to problems without any input or output constraints. Hence, the infinite horizon LQR technique is different from the infinite horizon formulation of MPC used in our application that is subject to all input and output constraints. As recited in paragraph [0023], last line of page 6:

> In a particular embodiment, the optimizer 150 includes a quadratic programming algorithm to optimize an objective function under given constraints. The optimizer determines the optimum values of control variables (i.e., actuator commands), and allows constraints to be specified relating to certain engine parameters, such as maximum temperatures, altitude and Mach number, while maximizing or minimizing an objective function, such as fuel efficiency or thrust.

Hence, Ward does not support a *prima facie* case of obviousness for one skilled in the art. Thus, Applicants respectfully request that the rejection based upon the Desai-Ward combination be withdrawn. Applicants respectfully request the Examiner to reconsider and withdraw the rejection of claims 1-38 on this basis.

Claims 2-6, 14, 15, 21-25, 33, 34 are rejected under 35 U.S.C. § 103(a) as being obvious over Brunell A or Brunell B, in view of each other or singly, and further in view of Ward.

Claims 2-6, 14, 15 depend on allowable base claim 1, and claims 21-25 depend on allowable base claim 20. Accordingly, these claims are believed to be clearly patentable at least by virtue of their dependency from an allowable base claim.

Hence, the Applicants respectfully request the Examiner to reconsider and withdraw the rejection of the claims on this basis.

Conclusion

In view of the remarks set forth above, Applicants respectfully request allowance of the pending claims. If the Examiner believes that a telephone interview will help speed this application toward issuance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,

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